

Welcome to

NASA Applied Remote Sensing Training Program (ARSET)

Webinar Series

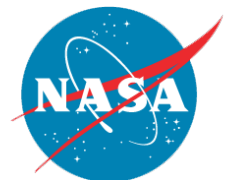
20 November 2012 : Week-5

Introduction to Remote Sensing Data for Flood and Drought Monitoring

Course Dates: Every Tuesday, November 6 - December 4, 2012

ARSET
Applied Remote Sensing Training

A project of NASA Applied Sciences



Webinar Presentations can be found at:

<http://water.gsfc.nasa.gov/webinars/>

For Webinar Recording Link :

Contact : Marines Martins

Email: marines.martins@ssaihq.com

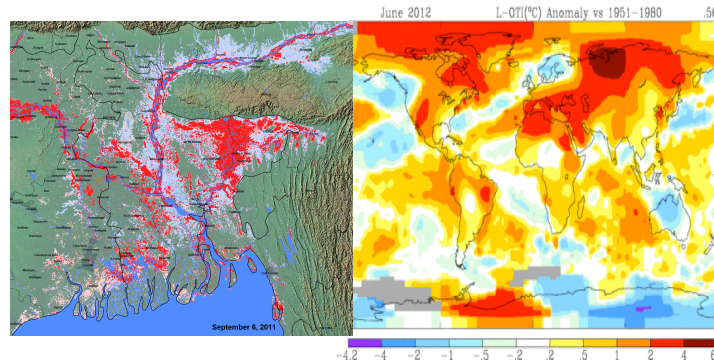
Course Outline

Week 1



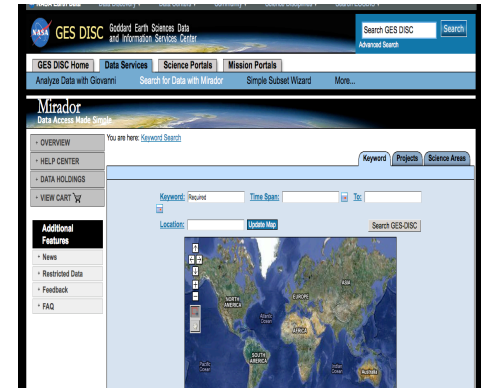
**Intro. & Background:
Satellite Remote Sensing**

Week 2



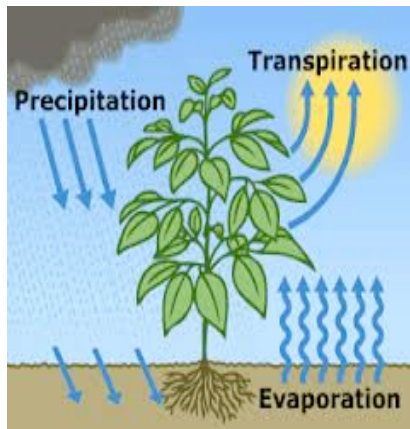
**Flood and Drought
[Rainfall, Weather
and Climate Data]**

Week 3



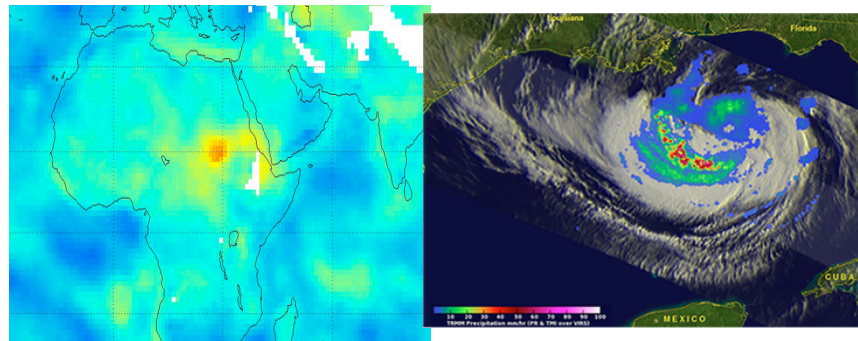
Web-tools

Week 4



Evapotranspiration

Week 5



Data Applications/ Case Studies

Week 5:Case Studies of Floods and Droughts

- Extreme rain events and associated weather conditions
- Inundation and Flooding
- Drought monitoring

Case Studies

- Extreme rain and flooding of Mississippi (May 2011)
- Flooding over Philippines (July-August 2012)
- Drought over US
- Drought over Brazil

About the Case Studies

Objective: To demonstrate the application of NASA remote sensing data and web-tools for analyzing past and current extreme rain/flooding events and drought, and developing monitoring strategies.

- Use of Level-3 /gridded data sets from TRMM, MERRA, GLDAS, AIRS, MODIS
- Use of various web-tools (Giovanni, US and Global Drought Monitors) for data access
- Qualitative studies – based on visual analysis of various data products in preparation for more advanced, quantitative usage and applications.

Web-Tools

Giovanni

<http://giovanni.gsfc.nasa.gov/>

TRMM

Flood Tool

[http://trmm.gsfc.nasa.gov/publications_dir/
potential_flood_hydro.html](http://trmm.gsfc.nasa.gov/publications_dir/potential_flood_hydro.html)

MODIS

Inundation Tool

<http://oas.gsfc.nasa.gov/floodmap/>

US Drought Portal

<http://www.drought.gov>

Global

Drought Monitor

<http://drought.mssl.ucl.ac.uk/>

Case 1: Mississippi River flooding (April-May 2011)

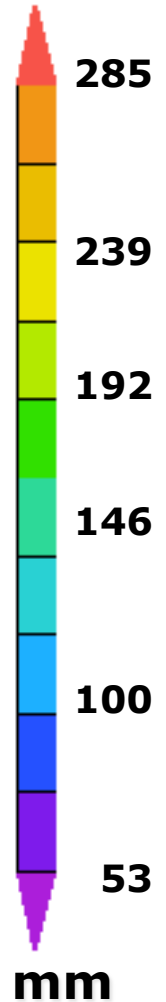
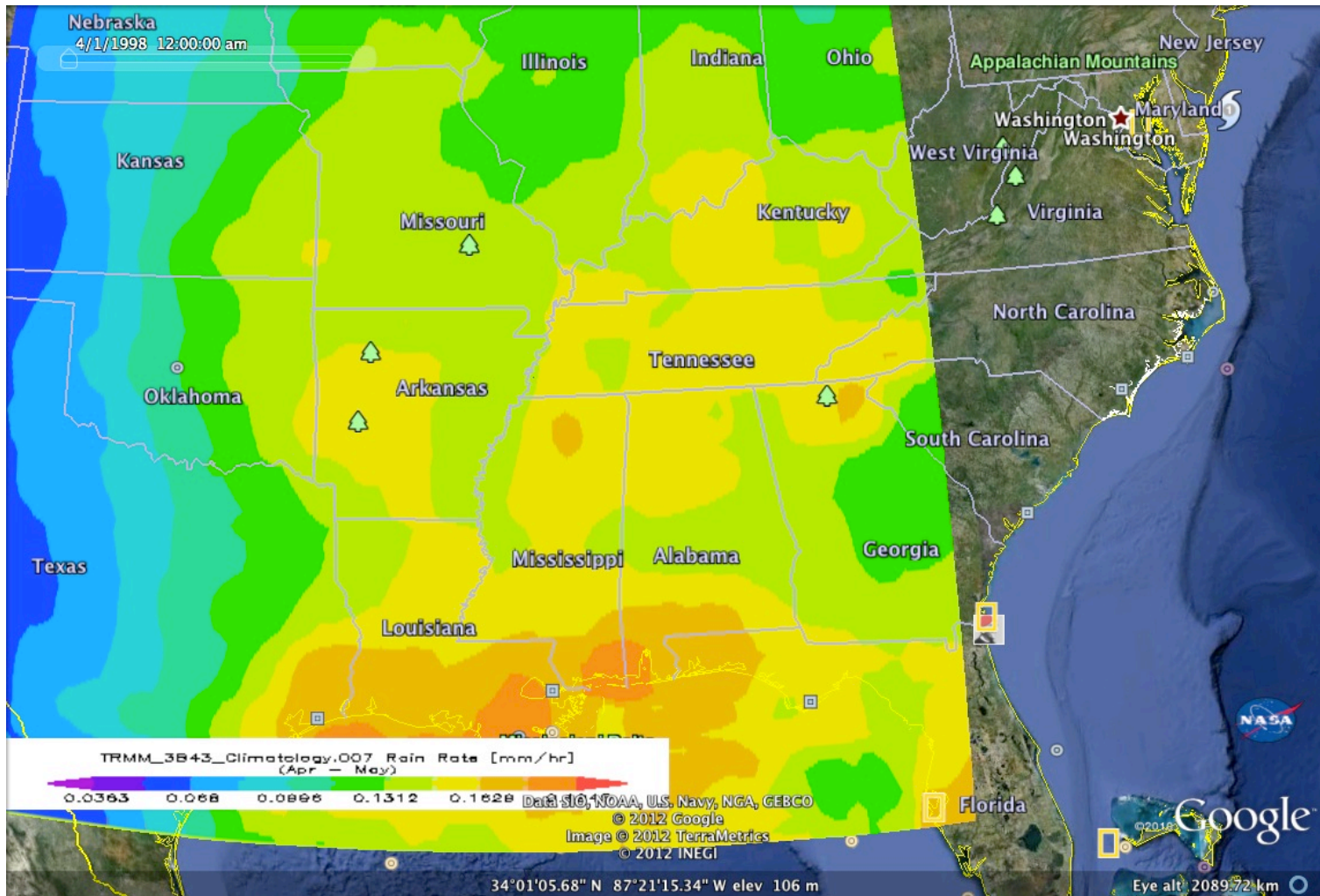
Mississippi River flooding (April-May 2011)



Excessive rainfall occurred from April 23 to May 7, 2011 across northern Arkansas, southern Missouri, and portions of the Ohio River Valley. **Fourteen day rainfall totaled more than 800% of normal rainfall** across parts of the Ohio, White and mid-Mississippi River valleys, with rain amounts up to 20 inches at some locations. This deluge resulted in record flooding in the lower Mississippi River.

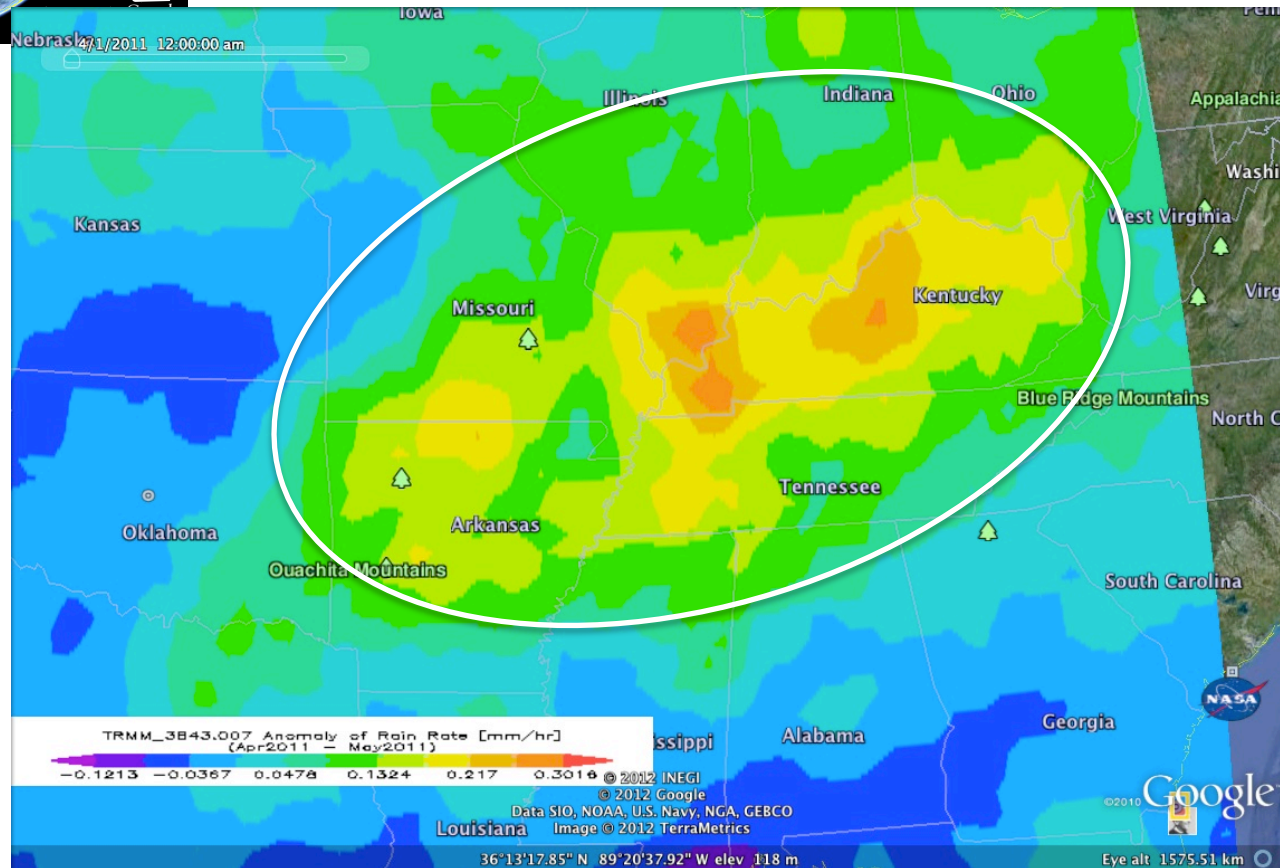
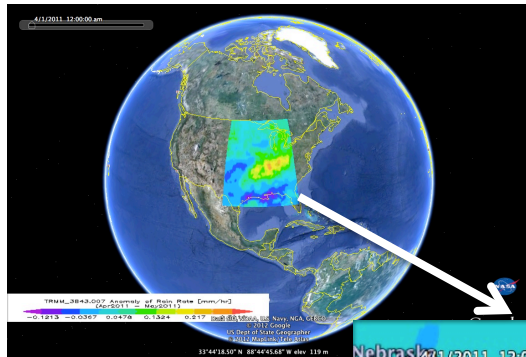
Rainfall Climatology from TRMM – TMPA (3B43) For April-May

Accumulated
Rain



Above-normal rainfall during April-May 2011 caused Lower Mississippi River flooding

Rain Rate Anomalies from TRMM-3B43
Note 300-400 mm more rain than normal



Total Anomalies (mm)

440

318

193

70

-53

-177

Heavy Rain in Early May caused Severe Flooding in Tennessee, Arkansas

Deepening trouble: Greater Memphis residents bracing as flooding threatens neighborhoods

By Cindy Wolff

Posted May 2, 2011 at midnight

Discuss

Print

A

A

A

f

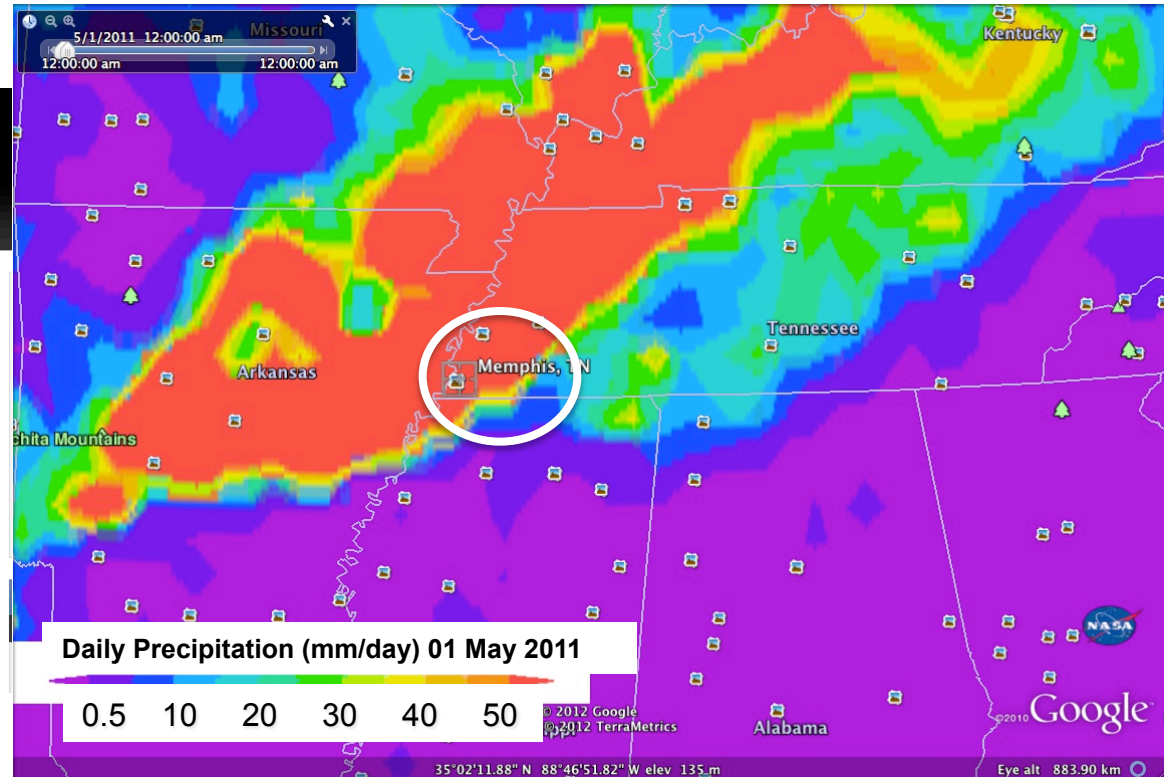
t

e

m



PHOTO BY JIM WEBER // BUY THIS PHOTO

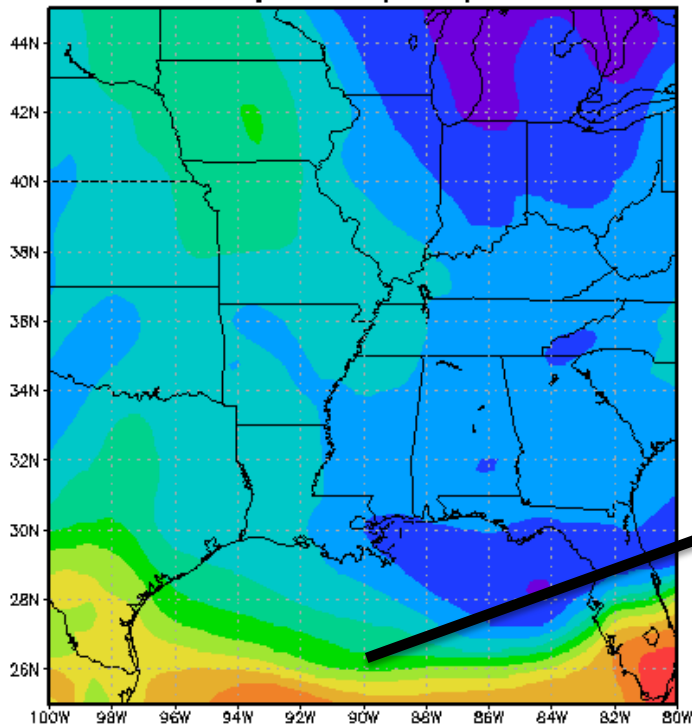


TRMM-TMPA 3B42 Over a large area rainfall greater than 50 mm day was observed on 1 May 2011

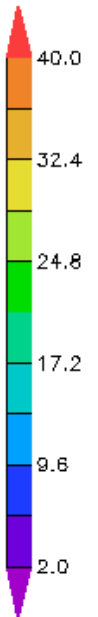
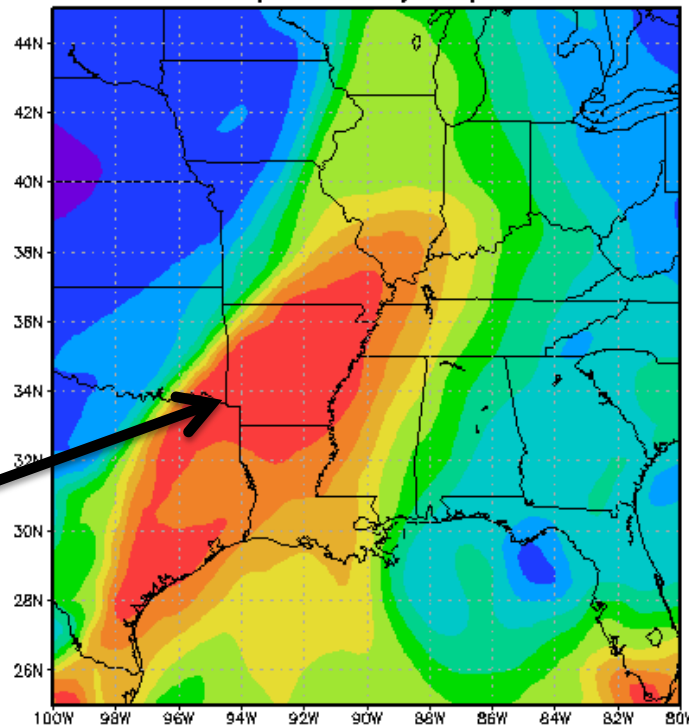
Lower Mississippi Flood

Total Atmospheric Moisture Dramatically increased between April 30th and May 1, 2011 -- **from MERRA**

MAI1NXINT.5.2.0 Total Q vapor (Total precipitable water) [kg/m2]
(00:00Z30Apr2011)



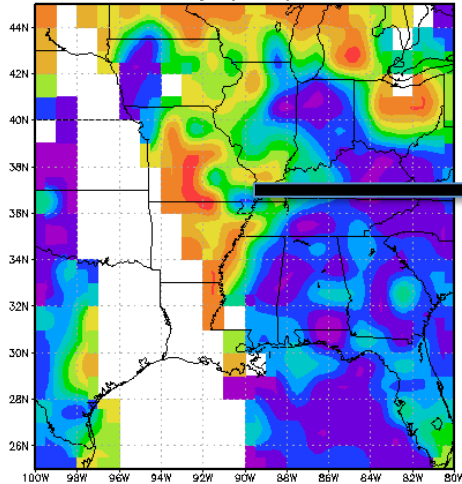
MAI1NXINT.5.2.0 Total Q vapor (Total precipitable water) [kg/m2]
(00:00Z01May2011)



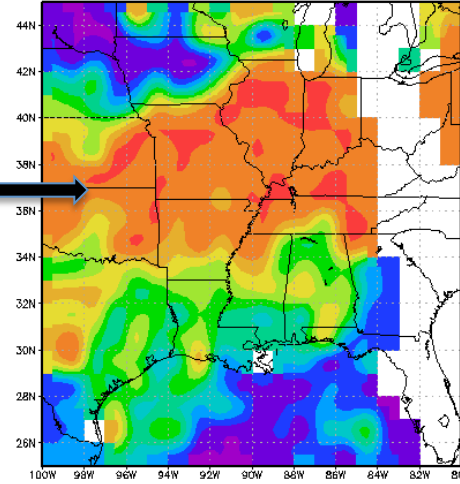
Lower Mississippi Flood

Cloudiness increases between April 30th and May 1, 2011 -- from AIRS

April 30

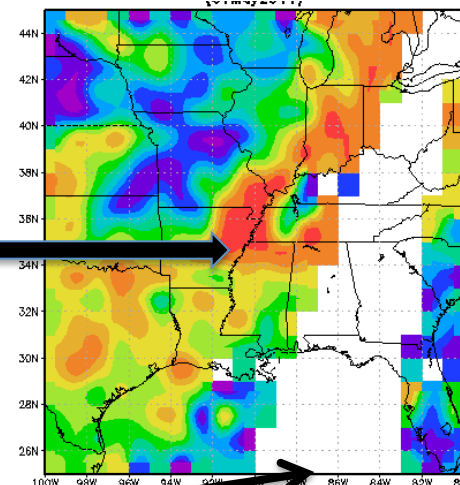
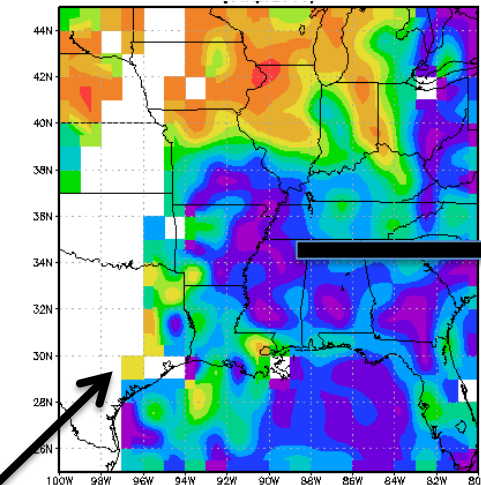


MAY 1



Ascending
orbit

Cloud fraction (fraction of a grid covered by clouds) – from 0 (totally cloud-free) to 1 (total overcast)



Descending
orbit

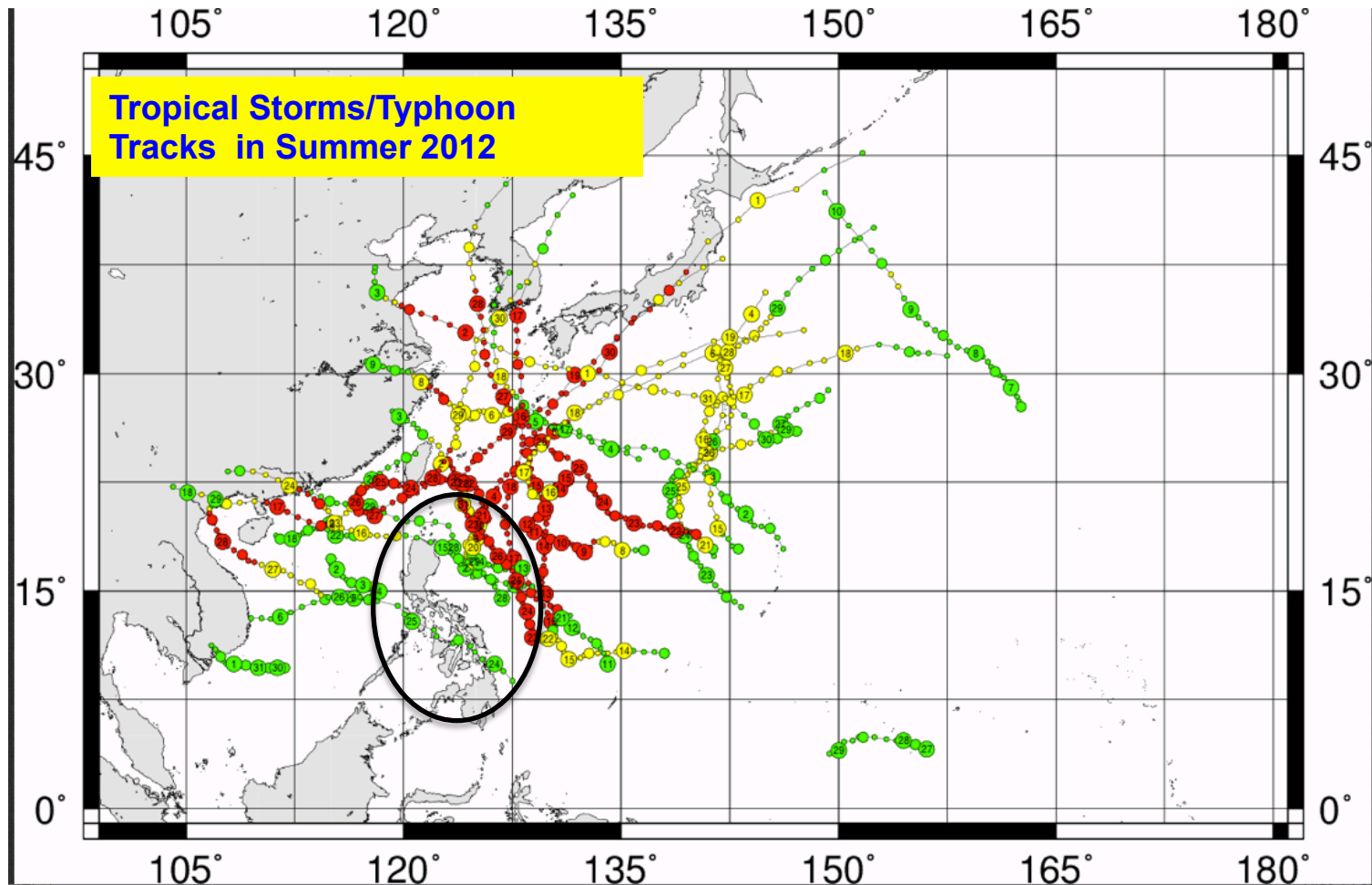
Orbital Gaps

From Giovanni web-tool

Case 2: Flooding over Philippines (June-July-August 2012)

Flooding over Philippines

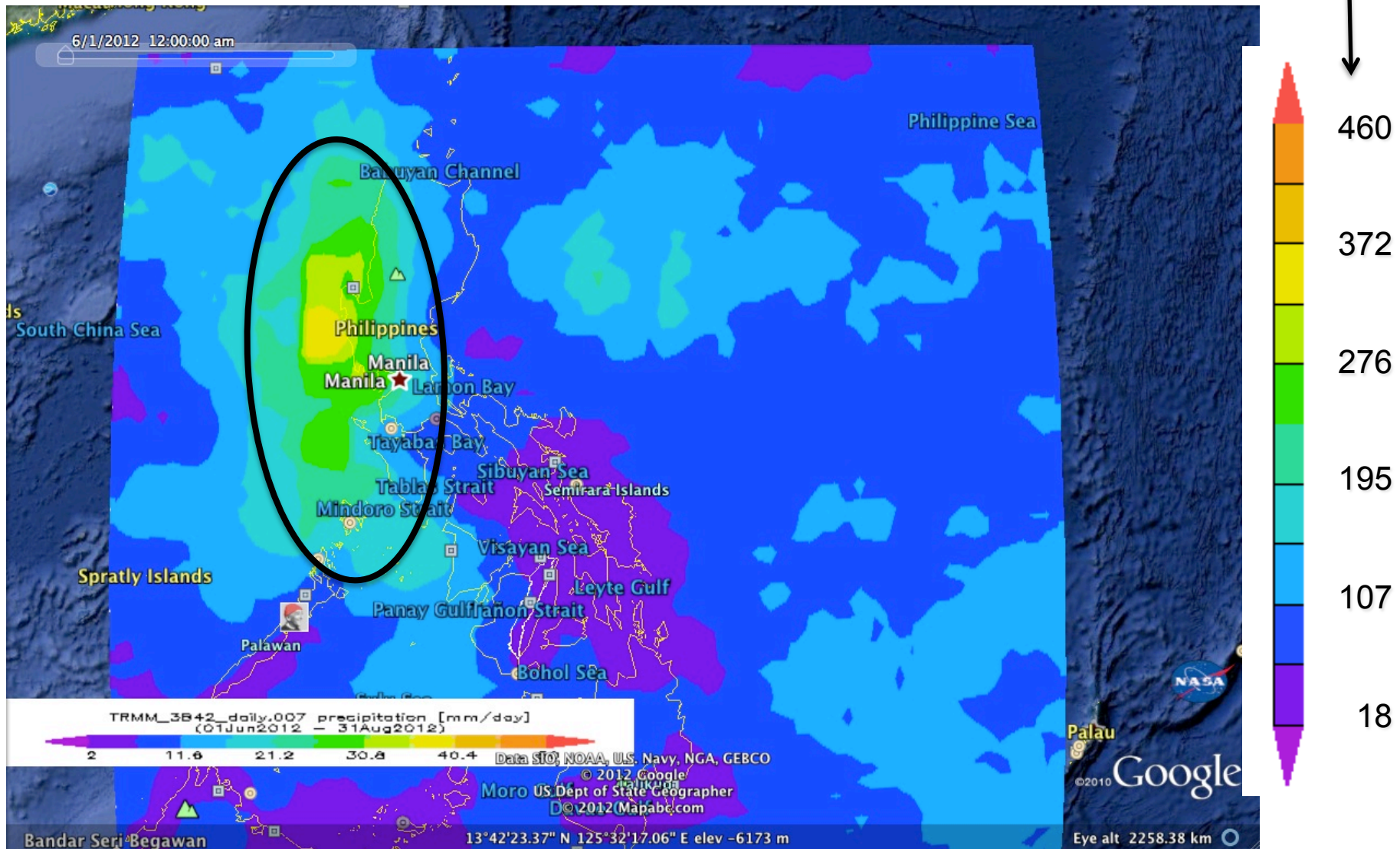
A series of tropical storms and during Summer monsoon of 2012 brought large amount of rain and widespread flooding over Philippines



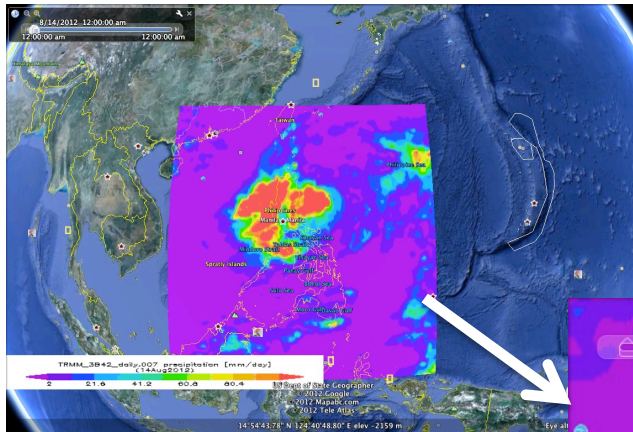
From: <http://agora.ex.nii.ac.jp/digital-typhoon/year/wnp/2012.html.en>

Flooding over Philippines

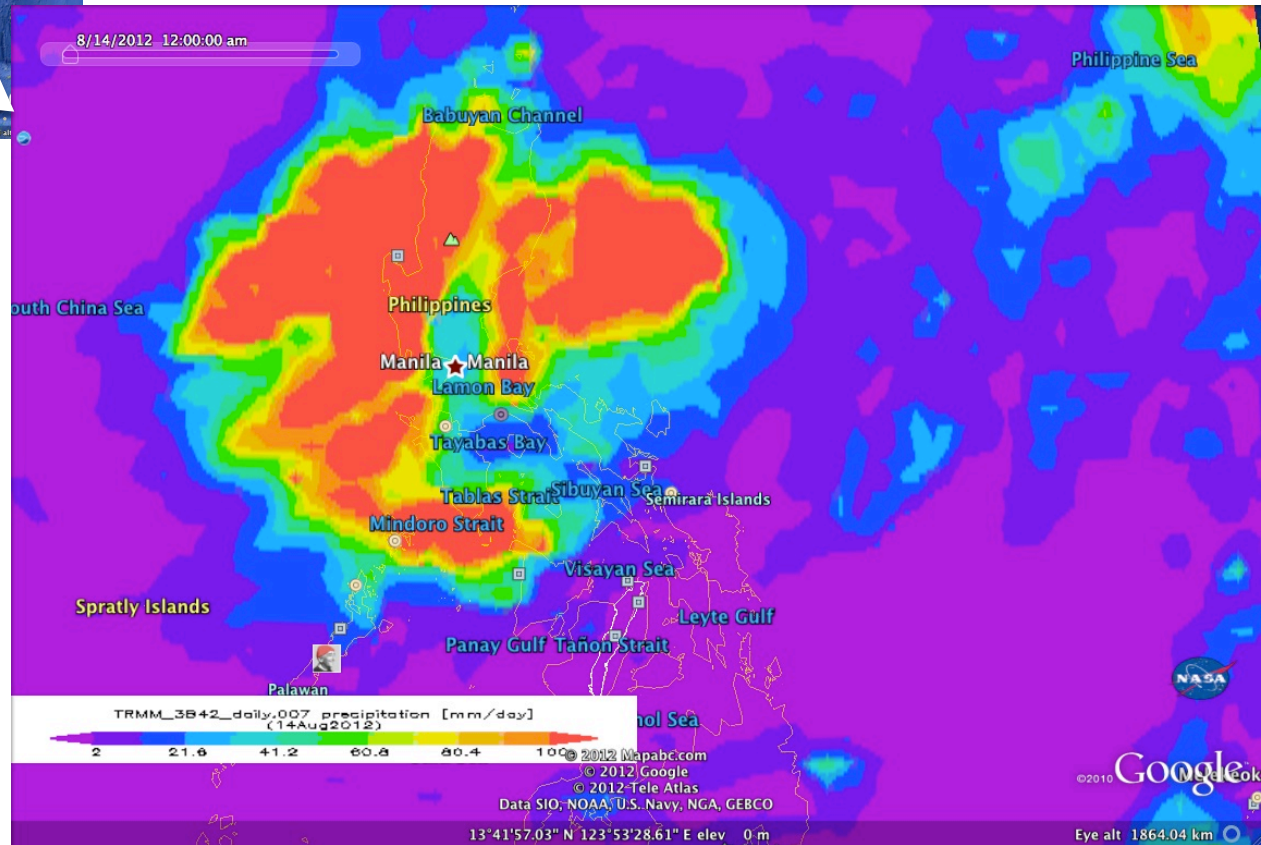
June-July-August 2012 Rainfall from TRMM 3B42 (**Accumulated Rain in Cm**)



Flooding over Philippines



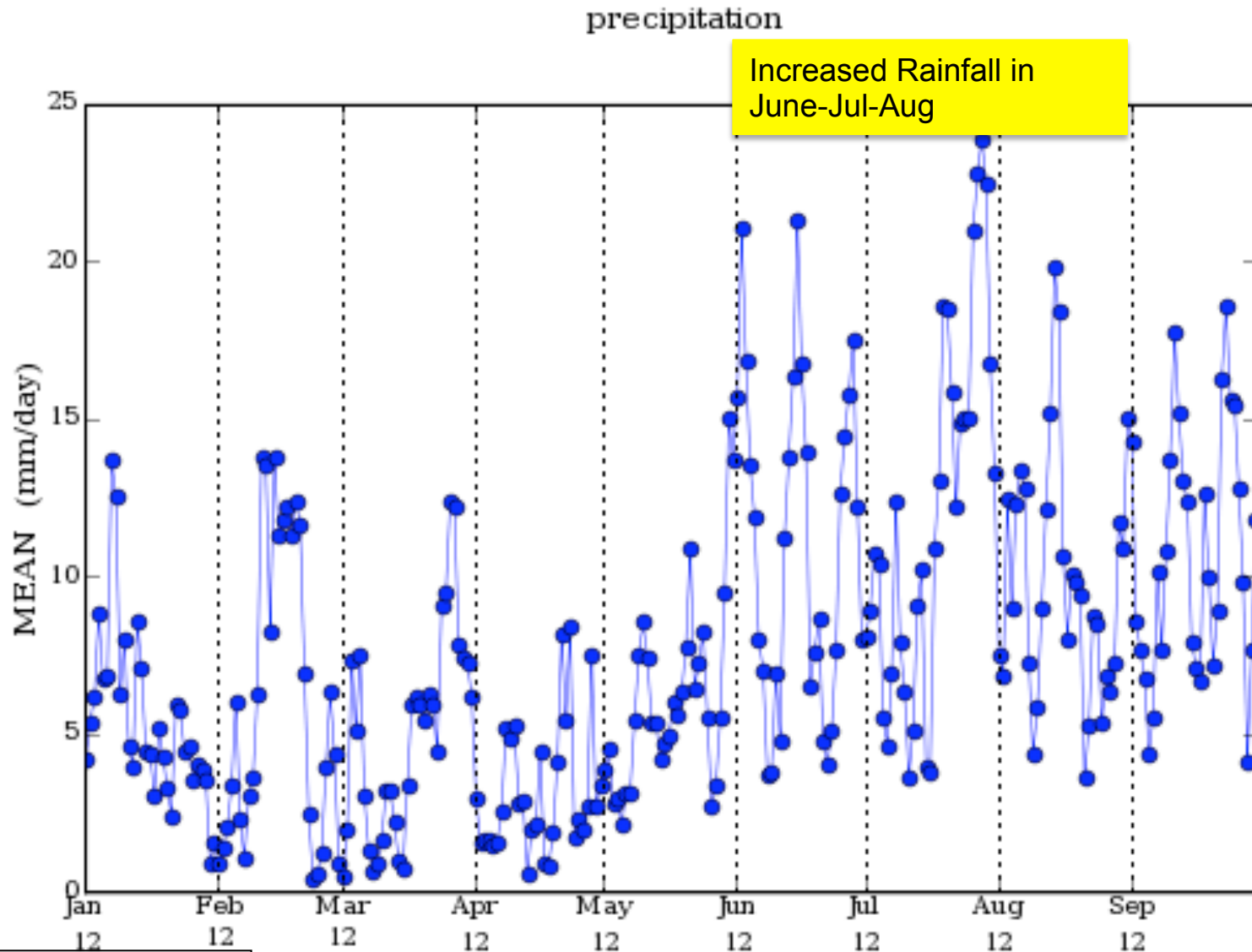
Typhoon Kai-Tak brought a large amount of rain



TRMM Daily Rain Rate observed on 15th August 2012. Rainfall greater than 100 mm/day was observed over Philippines and surrounding areas.

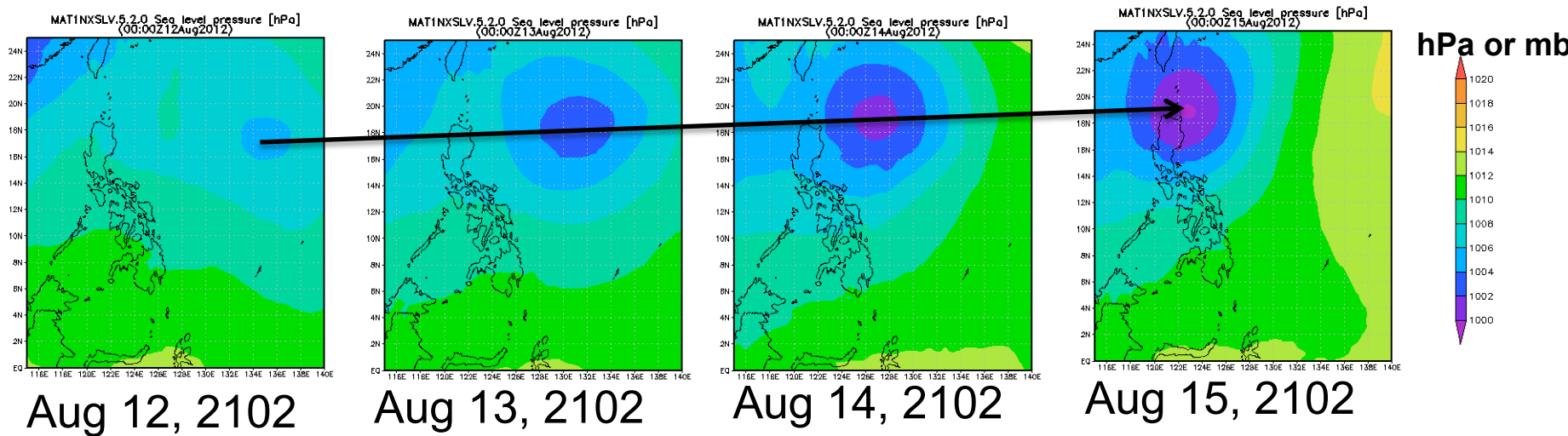
TRMM 3B42 Daily Rainfall – averaged over Philippines

Time Series, Area Statistics
(Region: 115E-134E, 4N-21N)



Flooding over Philippines – Typhoon Kai-Tak

Sea Level Pressure – from MERRA



Low-pressure center of the typhoon moving across Northern Philippines brings associated storm-scale winds and clouds resulting in extreme rainfall and flooding

Droughts

Droughts

It is relatively easy to define what a hurricane or flood is, defining a drought is more subjective. **Droughts do not have the immediate effects of floods, but sustained droughts can cause economic stress over large areas.**

To a farmer, a drought is a period of **moisture deficiency** that affects the crops under cultivation even two weeks without rainfall can stress many crops during certain periods of the growing cycle.

To a meteorologist, a drought is a prolonged period when **precipitation is less than normal.**

To a water manager, a drought is a **deficiency in water supply** that affects water availability and water quality.

To a hydrologist a drought is an extended period of **decreased precipitation and streamflow.**

(From USGS)

Some Drought Indicators

Precipitation

Surface Air Temperature

Evapotranspiration

Palmer Drought Index

(based on supply and demand of moisture at given location over given time)

Vegetation Index

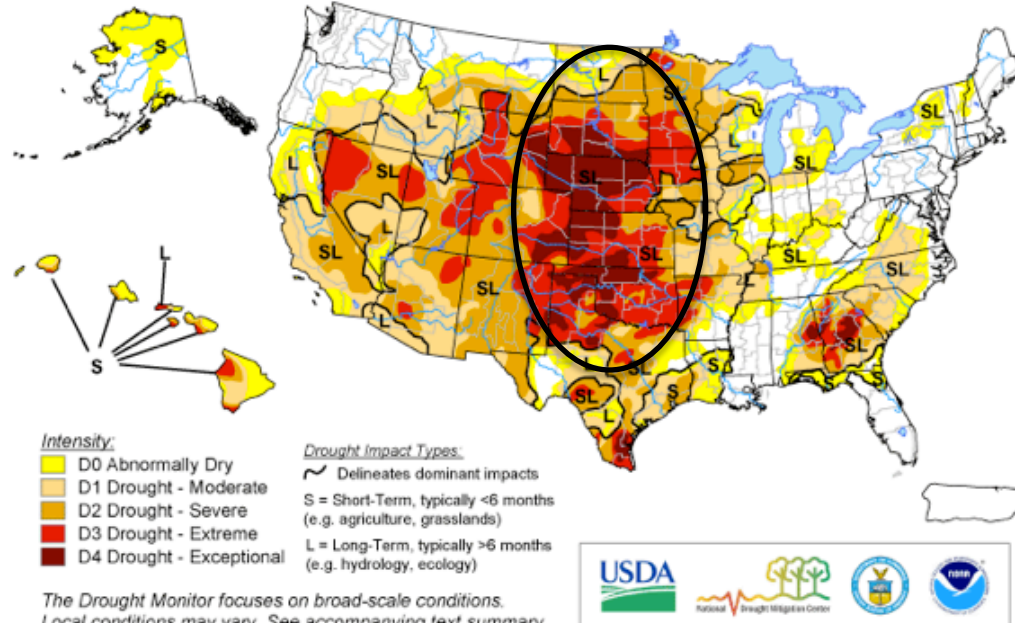
Case 3: Current Drought Conditions over the US

US Drought Monitor

Launch USDM

U.S. Drought Monitor

November 27, 2012
Valid 7 a.m. EST



Released Thursday, November 29, 2012

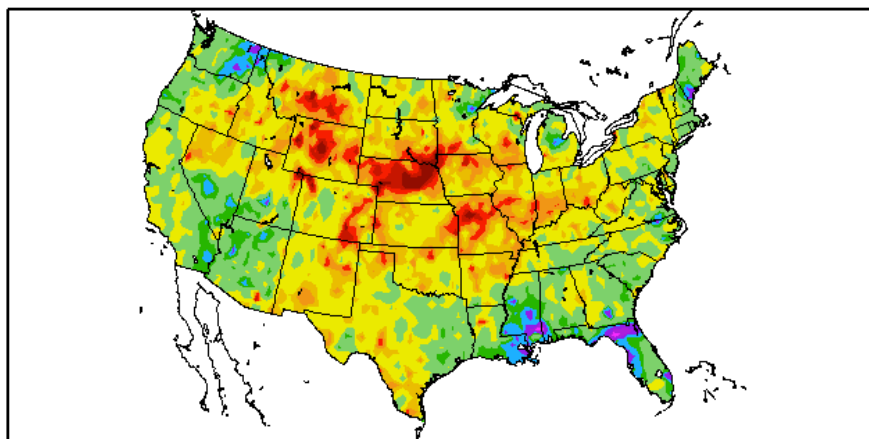
Author: Eric Luebbehusen, U.S. Department of Agriculture

From <http://www.drought.gov>

Standardized Precipitation Index (SPI)

Indicates widespread drought conditions over the US
in last six months (From <http://www.drought.gov>)

3-Month SPI
6/1/2012 – 8/31/2012



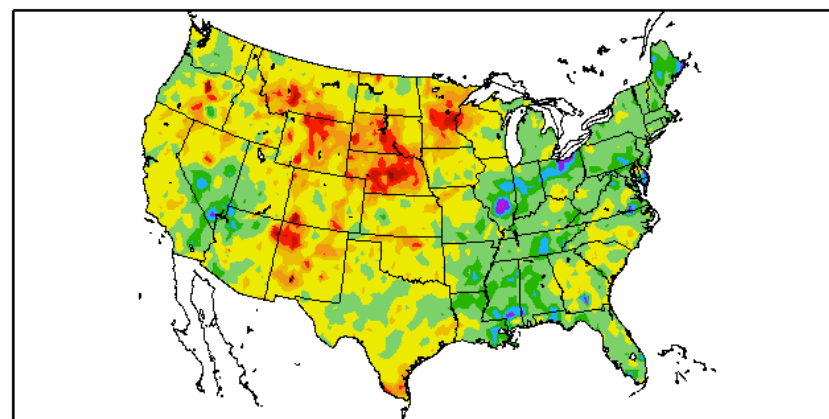
Generated 9/11/2012 at HPRCC using provisional data.

Regional Climate Center

This product is developed by the National Drought Mitigation Center (NDMC) and the High Plains Regional Climate Center (HPRCC).

June-July-August

3-Month SPI
8/1/2012 – 10/31/2012



Generated 11/11/2012 at HPRCC using provisional data.

Regional Climate Centers

This product is developed by the National Drought Mitigation Center (NDMC) and the High Plains Regional Climate Center (HPRCC).

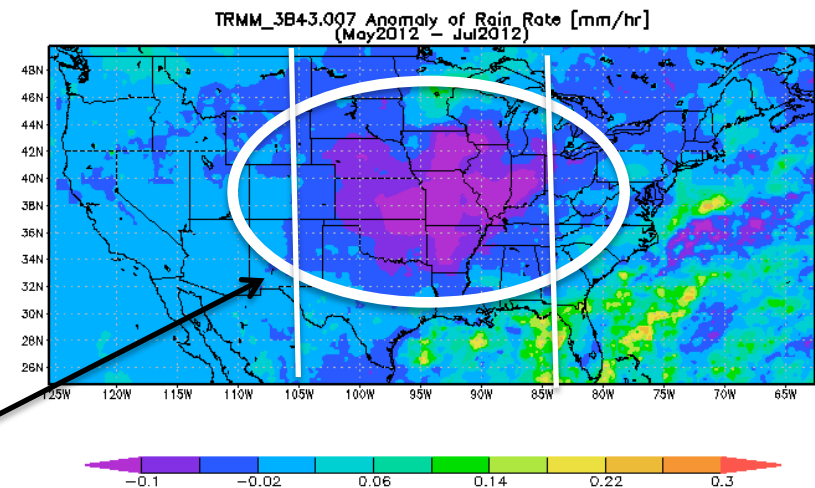
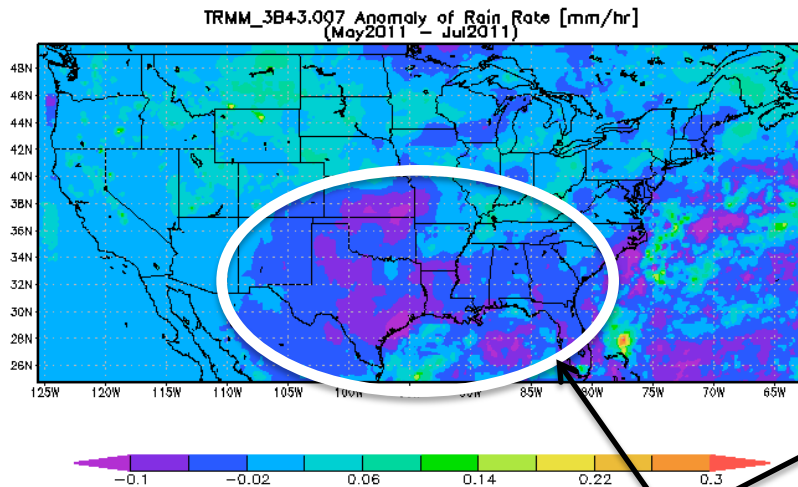
August-September-October

TRMM Rainfall Anomalies over the US Great Plains

Below-normal rainfall observed from TRMM-TMPA 3B43

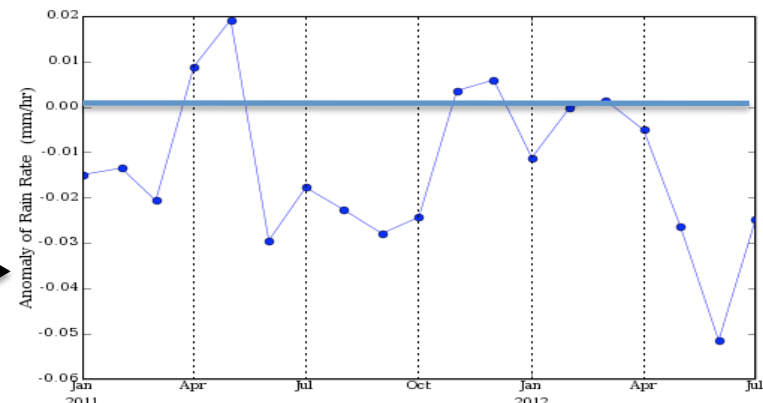
May-June-July: 2011

May-June-July: 2012



**50 to 200 mm deficit
compared to normal**

Area-Averaged Time Series (TRMM 3B43.007)
(Region: 115W-90W, 30N-50N)

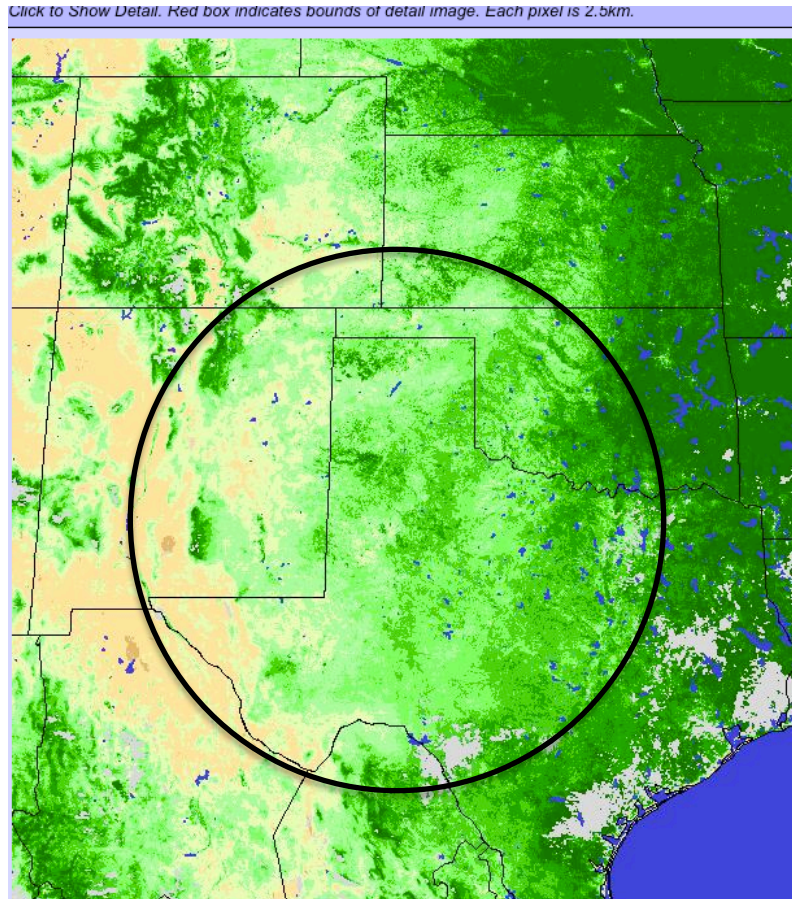


**Monthly Rainfall deficit over the US
Plains during 2011-2012 growing
seasons**

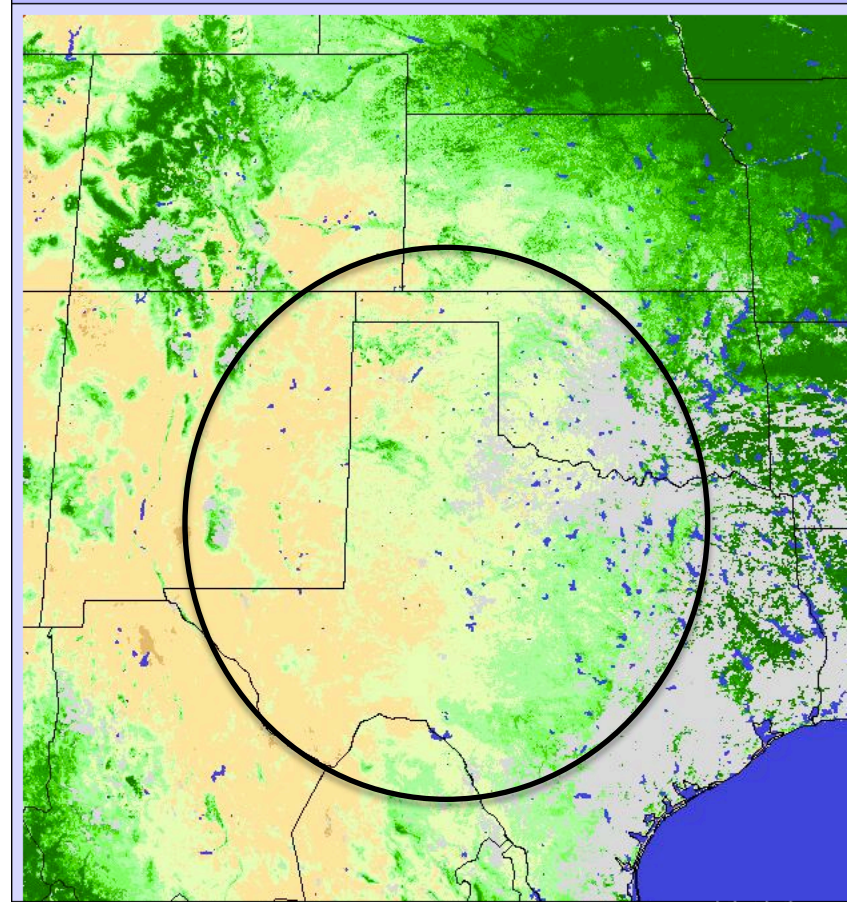
From Giovanni web-tool

MODIS NDVI over US Southern Plains

July 12-27 2010



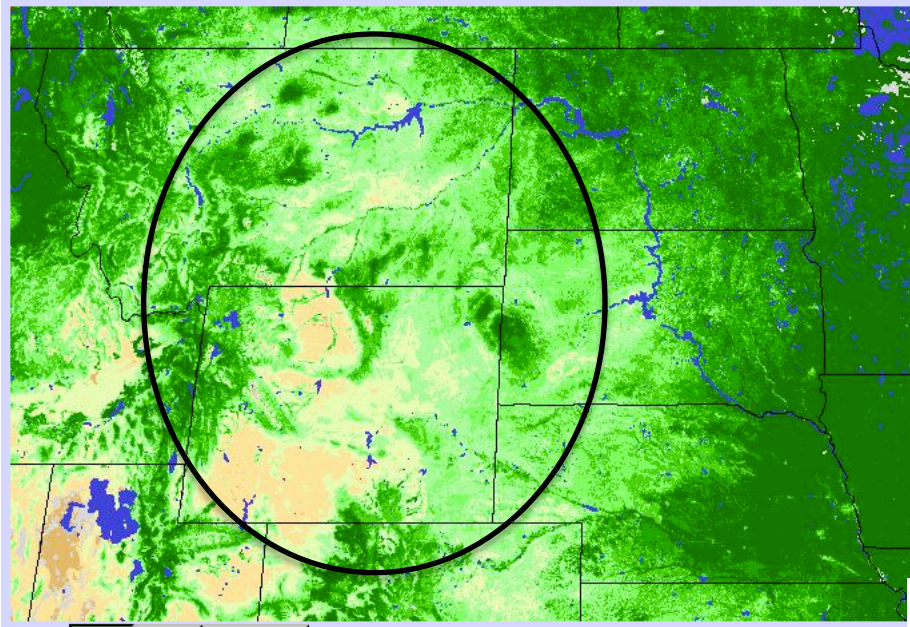
July 12-27 2011



Much sparser
vegetation in 2012

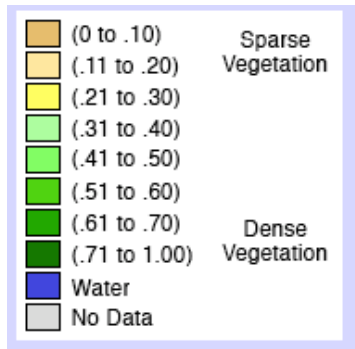
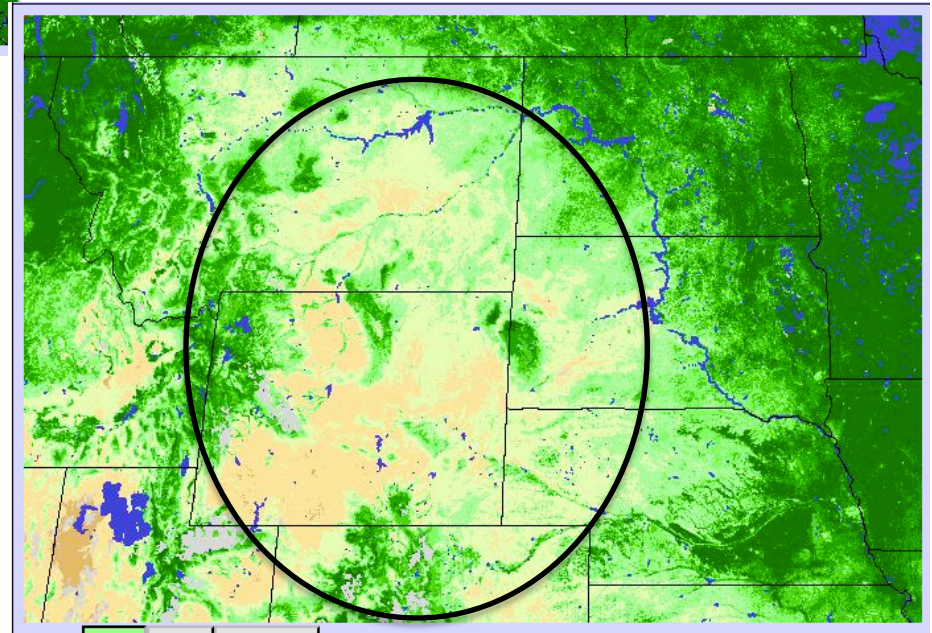
MODIS NDVI over US Northern Plains

July 12-27 **2010**



Much sparser
vegetation in 2012

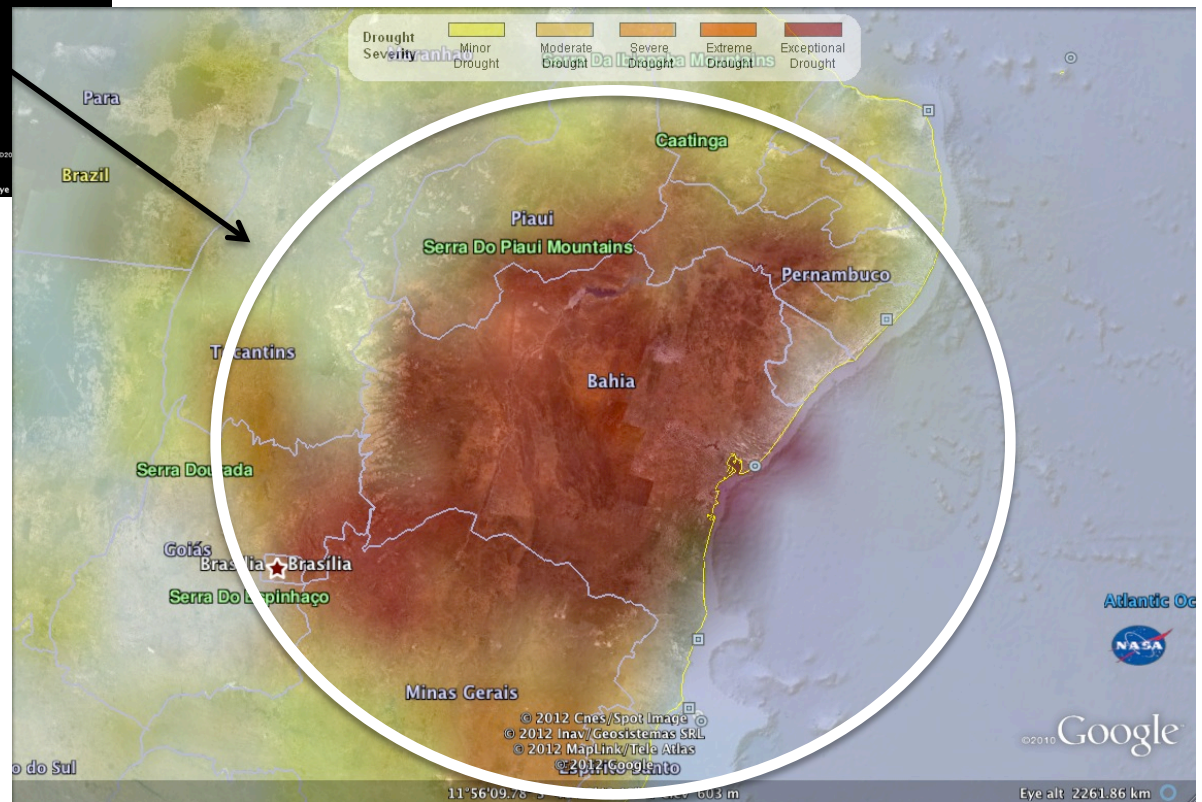
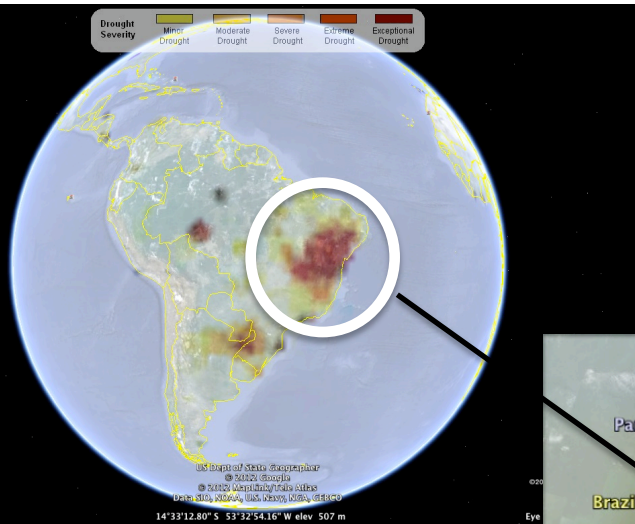
July 11-26 **2012**



Case 4: Drought Conditions over Brazil (2012)

Drought Conditions over Brazil in 2012

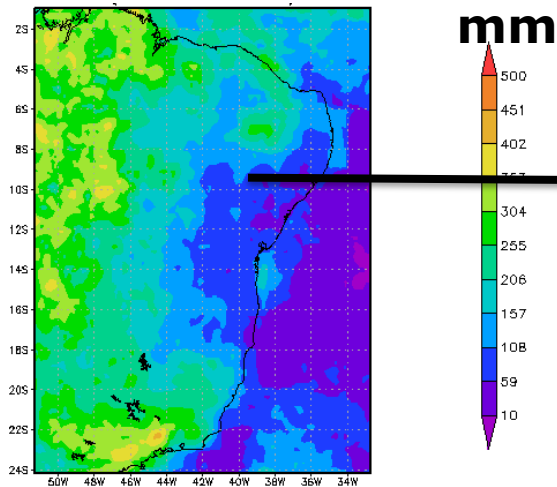
From Global Drought Monitor



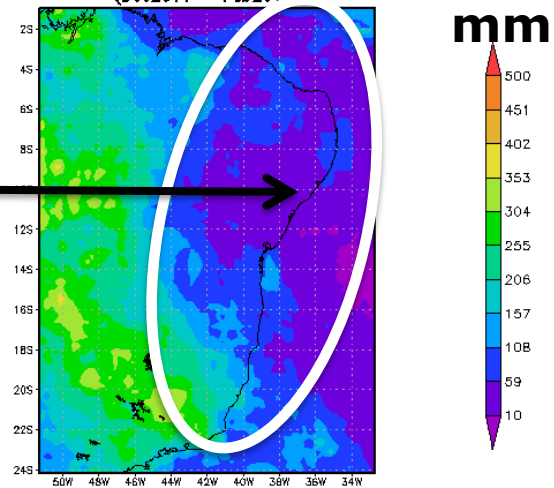
TRMM 3B43 Accumulated Rain over Brazil in 2011 and 2012

Rainfall deficit in 2012 rainy Season

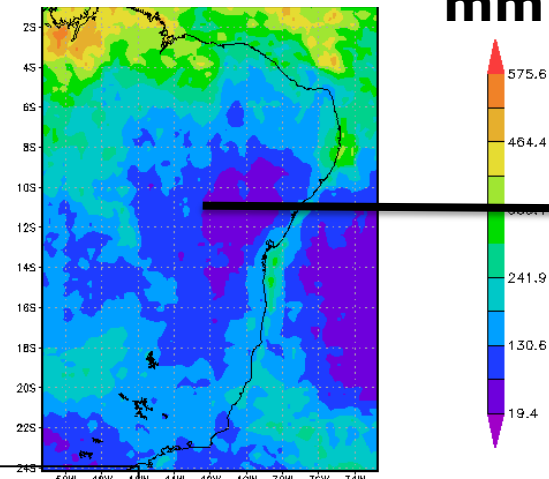
Dec-Jan-Feb 2011



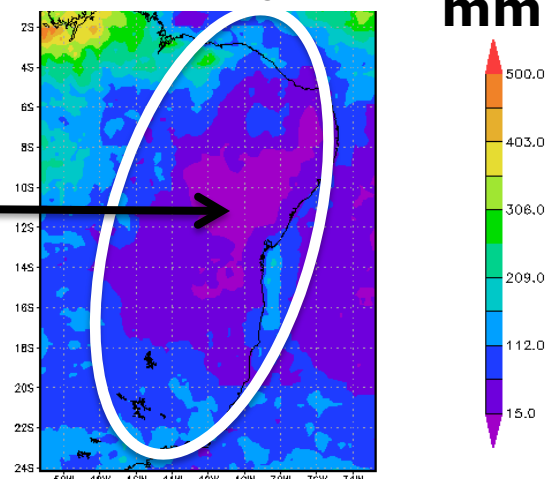
Dec-Jan-Feb 2012



Mar-Apr-May 2011



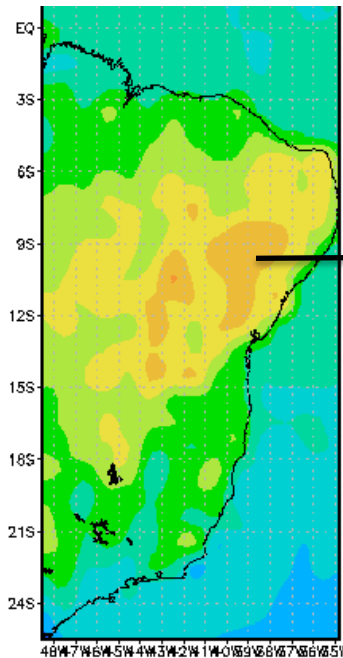
Mar-Apr-May 2012



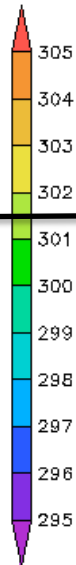
Drought Conditions over Brazil in 2012

Surface Air Temperatures from AIRS

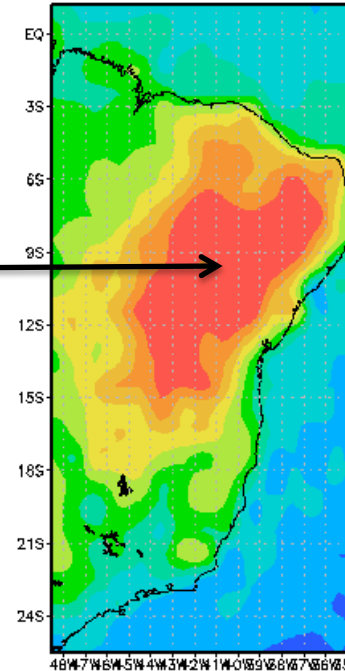
Dec 2010 - May 2011



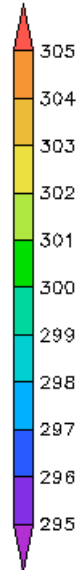
K



Dec 2011 - May 2012



K

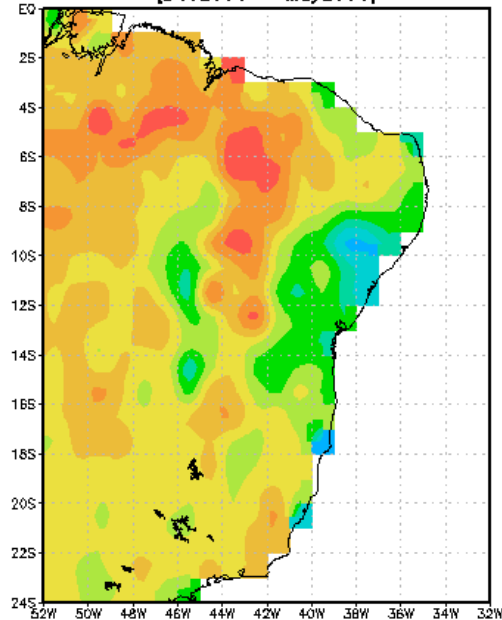


Warmer Surface Air Temperatures in 2012
when compared to 2011

Drought Conditions over Brazil in 2012

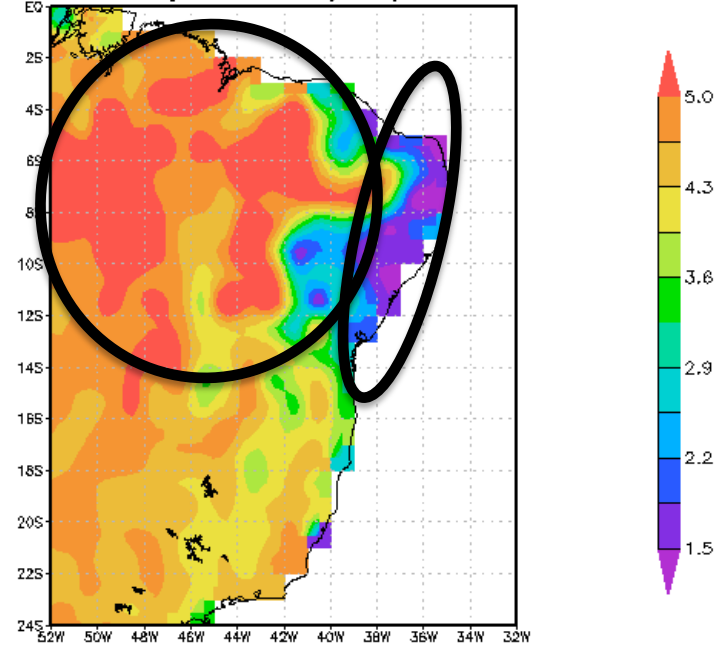
Evapotranspiration from GLDAS

GLDAS_NOAH10_M.001 Total evapotranspiration $[(10^{-5})\text{kg/m}^2/\text{s}]$
(Dec2010 - May2011)



Dec 2010 - May 2011

GLDAS_NOAH10_M.001 Total evapotranspiration $[(10^{-5})\text{kg/m}^2/\text{s}]$
(Dec2011 - May2012)



Dec 2011 - May 2012

Complex Evapotranspiration contrasts in 2011 and 2012

ARSET-Water Upcoming Webinar:

Snow Products for Water Resource Management

January 15 – February 5, 2013

Registration will open by next week

<http://water.gsfc.nasa.gov>

Week 1 *Foundations of Remote Sensing, Snow, and Snowmelt*

Week 2 *Snow Products for Water Resources Management Applications: Daily Snow Covered Area, Grain Size, and Albedo*

Week 3 *Snow Products for Water Resources Management Applications: Daily Dust Radiative Forcing in Snow*

Week 4 *Access to NASA Snow products: the NASA/JPL Snow Server*

ARSET Trainings

ARSET offers region-specific/data- and application-specific Trainings. If interested in a training you please contact Ana.I.Prados@nasa.gov and we will send you an application form.

Types of trainings offered:

Basic and advanced Webinars

Basic and advanced hands-on trainings

**Second assignment- due by 23rd December - is
available on
<http://water.gsfc.nasa.gov/webinars/>**

Next Q/A sessions: December 6 (8-9 a.m. EST)

Thank You!